CLAIMS

1. Method for the making of a digital Nyquist filter with null inter-symbol interference designed to process a physical signal transmitted between a sender and a receiver through a transmission channel,

said filter being an Nth order $P(z) = F^2(z)$ symmetrical filter implementing an oversampling factor M=4 and forming a matched pair comprising a sending filter (12) and a reception filter (15) whose polyphase breakdown of F(z) can be written as follows:

$$F(z) = F_0(z^4) + z^{-1}F_1(z^4) + z^{-2}F_2(z^4) + z^{-3}F_3(z^4)$$

characterized in that N is different from 4n, n being an integer:

and in that :

- If N=4n+1, $F_1(z)\hat{F}_1(z) + z^{-1}F_2(z)\hat{F}_2(z) = \gamma z^{-n}$
- If N=4n+2, $2F_0(z)\hat{F}_0(z) + F_1^2(z) + z^{-1}F_3^2(z) = \gamma z^{-n}$
- If N=4n+3, $F_0(z)\hat{F}_0(z) + F_1(z)\hat{F}_1(z) = \gamma z^{-n}$

$\hat{F}$ being the mirror symmetry of F and γ being a non-null constant.

2. Method according to claim 1, characterized in that N is equal to 4n+3 or 4n+1 and:

said sending filter (12) performs an interpolation (121) by a factor M = 4 and has a circuit arrangement corresponding to a polyphase breakdown known as the type II breakdown, such that:

$$_F F(z) = \begin{bmatrix} z^{-3} & z^{-2} & z^{-1} & 1 \end{bmatrix} \begin{bmatrix} \hat{F}_0(z^4) \\ \hat{F}_1(z^4) \\ F_1(z^4) \\ F_0(z^4) \end{bmatrix}$$

and said reception filter (15) performs a decimation (152) by a factor M = 4 and has a circuit arrangement corresponding to a polyphase breakdown known as the type I breakdown, such that:

$$F(z) = \left[F_0(z^4)\ F_1(z^4)\ \tilde{F}_1(z^4)\ \tilde{F}_0(z^4)\right]\begin{bmatrix}1\\ z^{-1}\\ z^{-2}\\ z^{-3}\end{bmatrix}$$

3. Method according to any of the claims 1 and 2, characterized in that, in said sending filter (12), a filtering step followed by a step of interpolation by a factor of M=4 is performed.

4. Method according to any of the claims 1 à 3, characterized in that, in said reception filter (15), a step of decimation by a factor M=4 is performed, followed by a filtering step.

5. Method according to any of the claims 1 to 4, characterized in that said sending filter (12) and/or said reception filter (15) have a structure in the form of at least one lattice.

6. Method according to claim 5, characterized in that said sending filter (12) and said reception filter (15) are each constituted by a pair of polyphase components respectively given by the following equations :

$$\begin{bmatrix}F_0\\ F_1\end{bmatrix} = gA(\alpha_n)\Lambda(z)A(\alpha_{n-1})\ldots\Lambda(z)A(\alpha_0)\begin{bmatrix}1\\ 0\end{bmatrix}$$

$$\begin{bmatrix}-\tilde{F}_1\\ \tilde{F}_0\end{bmatrix} = gA(\alpha_n)\Lambda(z)A(\alpha_{n-1})\ldots\Lambda(z)A(\alpha_0)\begin{bmatrix}0\\ 1\end{bmatrix}$$

with :

$$A(\alpha) = \begin{bmatrix}1 & \alpha\\ -\alpha & 1\end{bmatrix} \quad \text{and} \quad \Lambda(z) = \begin{bmatrix}1 & 0\\ 0 & z^{-1}\end{bmatrix}$$

where g is a non-null constant of standardisation and α_i are real coefficients.

7. Method according to claim 6, characterized in that it implements a two-lattice structure.

8. Method according to claim 6, characterized in that it implement a single-lattice structure working at a double frequency.

9. Device for the filtering of Nyquist digital signals with null inter-symbol interference designed to process a physical signal transmitted between a sender and a receiver through a transmission channel,

based on an Nth order $P(z) = F^2(z)$ symmetrical filter implementing an oversampling factor M = 4 and forming a matched pair comprising a sending filter (12) and a reception filter (15),

the polyphase breakdown of F(z) of this symmetrical filter being written as follows:

$$F(z) = F_0(z^4) + z^{-1}F_1(z^4) + z^{-2}F_2(z^4) + z^{-3}F_3(z^4)$$

characterized in that N is different from 4n, n being an integer,

- If N=4n+1, $F_1(z)\hat{F}_1(z) + z^{-1}F_2(z)\hat{F}_2(z) = \gamma z^{-n}$
- If N=4n+2, $2F_0(z)\hat{F}_0(z) + F_1^2(z) + z^{-1}F_3^2(z) = \gamma z^{-n}$
- If N=4n+3, $F_0(z)\hat{F}_0(z) + F_1(z)\hat{F}_1(z) = \gamma z^{-n}$

$\hat{F}$ being the mirror symmetry of F and γ being a non-null constant.